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Large-scale young Gould Belt stars across Orion

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Abstract

We report first results on the large-scale distribution of the ROSAT All-Sky Survey (RASS) X-ray sources in a 5000 deg^2 field centered on Orion. Our final aim is to study the properties of different widespread populations in the Orion Complex close to the Gould Belt (GB) in order to trace the star formation history in the solar neighbourhood.

1 Sample definition and candidate selection

We considered a ∼5000 deg^2 field centered on Orion and selected in this area ∼1500 young stellar object (YSO) candidates through X-ray criteria established by Sterzik et al. (1995). We then selected a ∼10^o×75^o strip (see Fig. 1) perpendicular to the GB and crossing the Orion star-forming region (SFR), as well as a ∼10^o×10^o region at $\alpha = 5^h34^m$ and δ=+22^{o}01' with enhanced X-ray space density. Some ∼200 stars inside the strip turn out to be YSO candidates (Fig. 1), while three stellar groups seem to have high X-ray space density: two of them are inside the strip, while the third one is close to $\alpha = 5^h34^m$ and δ=+22^{o}01'.

2 Observational data set and candidate characterization

Low-resolution spectroscopy ($R \sim 1\,000$) was obtained with the Boller and Chivens Cassegrain spectrographs attached to the 1.5m telescope of the ESO (Chile) and to the 2.1m of the Observatorio Astronómico Nacional de San Pedro Mártir (Mexico). High-resolution spectroscopy ($R \sim 30\,000 - 100\,000$) was performed using the FOCES spectrograph attached to the 2.2m telescope at the Calar Alto Observatory (Spain) and with the Coudé Echélle Spectrometer fed by the 1.5m CAT telescope (Chile).

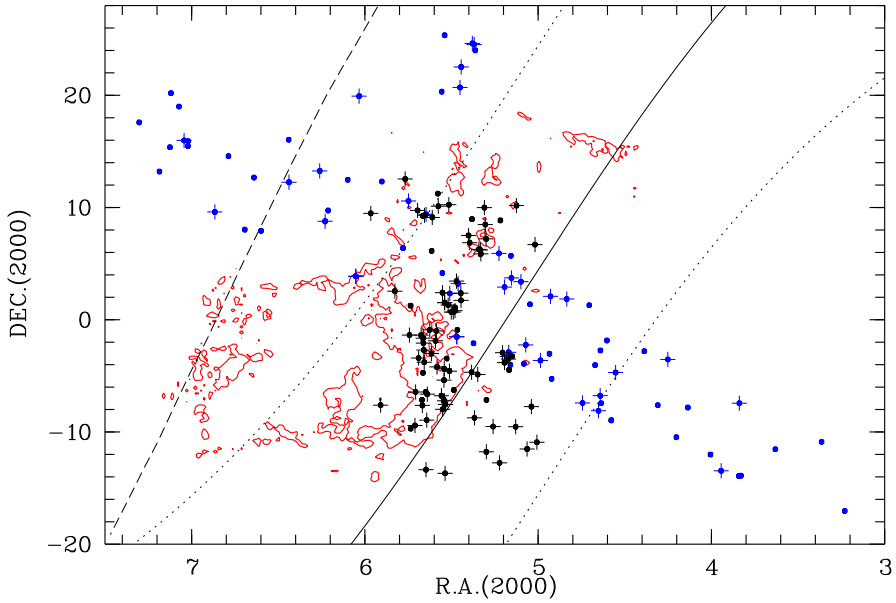

Figure 1: Large-scale spatial distribution of our targets in the strip and clumps observed at low and high resolution (blue symbols). The Alcalá et al. (2000) data are also shown with black symbols. Dots represent targets with low-Li content, while dots with crosses are stars with high-Li content. The positions of the three clumps are at (α = $5^{\rm h}34^{\rm m}$, δ=+22°01'), (α = $5^{\rm h}07^{\rm m}$, δ=−03°20'), and (α = $4^{\rm h}30^{\rm m}$, δ=−08°). Solid and dotted lines represent the GB and its limits (Guillout et al. 1998), while the dashed line represents the Galactic Plane. The CO emission map by Maddalena et al. (1986) is also overlaid in red.

Using the low-resolution spectra, we determined spectral types (and effective temperatures) and detected the presence of Hα and lithium line. This allowed us to select very young not-accreting stars (accretion is mainly associated with stars in the Orion SFR). We thus find that all stars located in the Orion region possess lithium stronger than the Pleiades stars of the same spectral type; many of the stars located in the region of the GB have also a strong Li content, but tend to be more similar to that of the Pleiades; and the majority of the field stars have lithium weaker than the Pleiades. From the high-resolution spectroscopy we determined rotational and radial velocity and measured lithium abundance. Preliminary results show that stars in the strip are segregated in three populations: clustered stars in Orion, with ages of 2-5 Myr; non-clustered stars in the GB with ages of 5-10 Myr; field stars with a wide age spread; while, stars in stellar groups show ages <20 Myr.

3 Work in progress and Future perspectives with GAIA

Following the prescriptions given by Biazzo et al. (2011), we are measuring the metallicity of single stars with low $v \sin i$ and observed at high resolution. Two main preliminary results are the following: i) stars with high-Li content show a distribution in agreement with that of young nearby clusters, i.e. close to the solar one; ii) stars with no Li absorption show wide [Fe/H] values, which resemble the distribution of field stars in the solar neighborhood.

Thanks to the future GAIA mission we will obtain parallaxes for our targets with a

precision of 0.014-0.070 mas, which will translate into 1-7 pc at the Orion distance. This will allow us to derive the distance to the individual stars and to place them on the HR diagram with accuracy of 0.7-1.4% in $\log(L/L\odot)$. Therefore, GAIA will allow us to definitively establish the nature of the widespread population of young stars on a Galactic scale.

References

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